CURRENT LITERATURE

NOTES FOR STUDENTS

Ecological terms and concepts.—Ecology, one of the latest branches of botanical science, has naturally an immature and incomplete terminology, although several of its followers have made attempts to remedy the latter defect. Some of the recent discussions of problems of terminology are worthy of note, not so much for their contributions to nomenclature, as to their logical division of the subject and their criticism of the mistakes of the past. This seems particularly true of an article by PAVILLARD,[1] in which he begins with a historical and critical sketch of conditions in the past, and proceeds with an analysis of the scope of plant geography. Here it is suggested that it would be desirable for all to follow the practice of the Swiss school and employ the designation "geobotany" suggested by GRISEBACH in 1866. Two main divisions of the science are then made, resting upon the two fundamental units of the species and the association. It is further suggested that the latter be appropriately termed plant sociology or phytosociology, and that the problems of each division be segregated into three categories, giving as the subdivisions of the subject: (1) Floristic geobotany, (2) Genetic geobotany, (3) Ecologic geobotany, (4) Floristic phytosociology, (5) Genetic phytosociology, and (6) Ecologic phytosociology. Whether this classification be universally adopted or not, it has much to recommend it in logical clearness, and, further, it shows considerable agreement with the best usage of the past.

The content of floristic geobotany would remain the same as for floristic plant geography as delimited by WARMING in 1895, while ecologic geobotany would not differ materially from the autecology of SCHRÖTER in giving emphasis to the relationship of the individual species to its habitat and the growth form by which it responds to its environment. To genetic geobotany would be referred such questions as the geographical aspect of the origin of species, heterogenesis, and endemism.

In the division devoted to problems connected with the plant association, the use of the term phytosociology or plant sociology was proposed by JACCARD in 1910, and employed in a more limited sense by HARPER.[2] The second and third subdivisions seem about equivalent to SCHRÖTER's synecology, genetic

[1] PAVILLARD, J., Les progrès de la nomenclature dans la géographie botanique. Ann. Geogr. **27**:401–415. 1918.

[2] HARPER, R. M., The new science of plant sociology. Sci. Monthly **4**:456–460. 1917.

phytosociology being almost exactly the same as COWLES's[3] physiographic ecology, while ecologic phytosociology corresponds very closely to WARMING'S ecological plant geography. To floristic phytosociology would be referred not only the enumeration of the flora of the associations, but also more exact studies as to the importance of the species to the community, and the constancy of the relationship. These relationships are discussed in detail by PAVILLARD[4] in a more recent paper. One phase of this relationship has been estimated in a quantitative manner by BRAUN-BLANQUET,[5] by giving to each species in an association a coefficient of affiliation (Gesellschaftstreue), the first rank (5) being conferred upon species confined exclusively to the particular association, and the lowest (0) belonging to ubiquists. To this PAVILLARD adds another evaluation of the species, based upon its importance in development and maintenance of the association, and expressed as its genetic coefficient, and here also the numerical value is also from 5 to 0. Analyzed in such a manner, the floristic composition seems to PAVILLARD decidedly the best manner of characterizing an association. The characterization of the plant association by floristic composition only is also insisted upon by DU RIETZ and his associates.[6] They also favor attention to priority in the use of ecological terminology, a concession that ecological writers are not likely to grant. DU RIETZ contends that the Swedish school of ecologists is distinguished by the use of true inductive methods as contrasted with the less desirable procedure of other workers. He also proposes certain new terms of minor importance.

GAMS[7] is less modest in his demands, for he wishes to abolish the use of formation, association, and most other synecological (or biocoenological) terms now current, because they have been and still are being employed in different senses by different writers. Instead of such fairly familiar terms, he would substitute a new set founded to some extent on new concepts. He contends that two types of units, the ecological and topographical, have been confused and should be distinguished with care. The former he calls "synusia" (associations), and distinguishes three grades where the component elements

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[3] COWLES, H. C., The physiographic ecology of Chicago and vicinity. BOT. GAZ. **31**:73–86. 1901.

[4] PAVILLARD, J., Remarques sur la nomenclature phytogéographique. Montpellier. pp. 27. 1919.

[5] BRAUN-BLANQUET, J., Eine pflanzengeographische Excursion durch Unterengadin und in dem schweizerischen National Park. Bericht. Schw. Bot. Gesells. **26**:1–79. 1918.

[6] DU RIETZ, C. E., FRIES, T. C. E., and TENGWALL, T. A., Vorschlag zur Nomenklatur der soziologischen Pflanzengeographie. Svensk. Bot. Tidskrift **12**:145–170. 1918.

[7] GAMS, H., Prinziprenfragen des Vegetationsforschung. Ein Betrag zur Begriffsklarung und Methodik der Biocoenologie. Vierteljahrschr. Naturf. Gesells. in Zurich **63**:293–493. 1918.

of the unit are respectively (1) of the same species, (2) of different species but of the same growth forms and of similar aspect, and (3) of different species and various growth forms presenting different series of aspects but united into an ecological unit in a single habitat by fixed correlation. This last grade of synusium corresponds very nearly with the "association" of most authors. Similar synusia are grouped as "isocies." For the topographical unit he adopts the word "biocoenose" (or biocoenosium), and uses it for the vegetation of a unit habitat. Biocoenosia of different regions which are compounded of isocies are called "isocoenosia."

The author rejects all attempts to classify vegetation units upon dynamic lines. He also gives a new classification of life forms, based largely upon the RAUNKIAER system, but more extended and including animals. It is safe to predict that such revolutionary changes as those urged by GAMS, even if they are logically conceived, will not be acceptable to the ecologists of America, and, judging from the criticism of the scheme by PAVILLARD (1919), they will meet with no greater favor in France.—GEO. D. FULLER.

Statistical methods in ecology.—It seems appropriate that from among the students of that father of modern ecology, EUGENE WARMING, should come a leader of perhaps the most promising line of advance in the ecology of today. RAUNKIAER more than any other has opened the way for the introduction of quantitative methods in the study of vegetation. His method of comparing the floras of different regions by means of a numerically expressed biological spectrum,[8] and of evaluating the mesophytism of a habitat by leaf classes,[9] have been noted in this journal. The latter method of estimating vegetation was made more familiar to American ecologists by the translation of FULLER and BAKKE,[10] who also included in their article a summary of a statistical method that had been familiar to Danish readers for some years.[11]

In a more recent article RAUNKIAER[12] has summarized the material of his former contributions, and has been able to show something of their applications to the solution of ecological problems. His statistical or valence method consists in determining the relative abundance of the different species composing a plant community of definitely limited extent, called by him a "formation," although more nearly equivalent to an association as understood by American ecologists. This determination is made by taking a census of a

[8] BOT. GAZ. **51**:309–310. 1911. [9] BOT. GAZ. **63**:242. 1917.

[10] FULLER, GEO. D., and BAKKE, A. L., Raunkiaer's life-forms, leaf-size classes, and statistical methods. Plant World **21**:25–37, 57–63. *fig. 1.* 1918.

[11] RAUNKIAER, C., Formations undersgelse og Formationsstatistik. Bot. Tidskr. **30**:20–132. 1909.

———, Om Valensmetoden. Bot. Tidskr. **34**:304–311. 1917.

[12] ———, Recherches statistiques sur les formations végétales. Det. Kgl. Danske Videnskabernes Selskab. Biol. Meddeleser. I **3**: pp. 80. *figs. 3.* 1918.